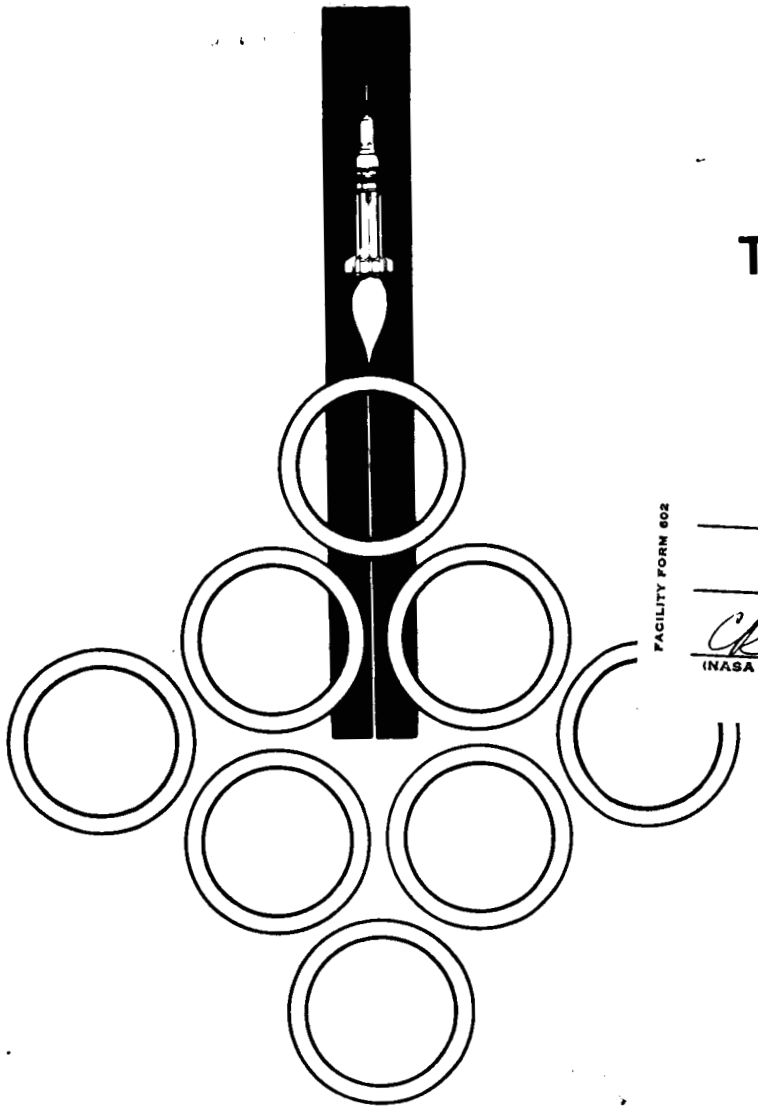

ENGINEERING DEPARTMENT

TECHNICAL MANUAL

SDES-64-415

Saturn I

LAUNCH VEHICLE SA-10 AND LAUNCH COMPLEX 37B FUNCTIONAL SYSTEMS DESCRIPTION

Volume VI

ENVIRONMENTAL CONDITIONING SYSTEMS FUNCTIONAL DESCRIPTION, INDEX OF FINDING NUMBERS, AND MECHANICAL SCHEMATICS

SPACE DIVISION CHRYSLER CORPORATION

SDES-64-415

SATURN I
LAUNCH VEHICLE SA-10
AND
LAUNCH COMPLEX 37B
FUNCTIONAL SYSTEMS DESCRIPTION

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ENVIRONMENTAL CONDITIONING SYSTEMS FUNCTIONAL DESCRIPTION, INDEX OF FINDING NUMBERS, AND MECHANICAL SCHEMATICS

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FOREWORD

This volume is one of a set of eleven volumes that describe mechanical and electro-mechanical systems of the Saturn I, SA-10 launch vehicle and launch complex 37B. The eleven-volume set is prepared for the Functional Integration Section, Systems Integration and Operations Branch, Vehicle Systems Division, P&VE Laboratory, MSFC, by Systems Engineering Branch, Chrysler Corporation Space Division under Contract NAS 8-4016. Volume titles are listed below:

Volume I	RP-1 Fuel System
Volume II	LOX System
Volume III	LH_2 Fuel System
Volume IV	Nitrogen and Helium Storage Facility
Volume V	Pneumatic Distribution System
Volume VI	Environmental Conditioning Systems
Volume VII	Launch Pad Accessories
Volume VIII	H-1 Engine and Hydraulic System
Volume IX	RL10A-3 Engine and Hydraulic System
Volume X	Separation and Flight Termination Systems
Volume XI	Supplement: Legend and Composite Schematic

The technical content of this volume reflects the most up-to-date design information available from the S-I/S-IB Project Engineer, R-P&VE on July 15, 1964.

System mechanical schematics are provided in section 3 to support the functional description of the system. The index of finding numbers in section 2 provides physical and functional descriptions of components identified on the mechanical schematics.

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SECTION 1

FUNCTIONAL DESCRIPTION

1.1 INTRODUCTION

The environmental conditioning systems on launch complex 37B regulate the atmospheric environment of the SA-10 vehicle and launcher area prior to launch. There are three systems, each with a different function to perform. These systems are: the environmental control system (ECS), the GN_2 deluge purge system, and the water quench system.

Components of the systems are located in several areas: launch control center (LCC), automatic ground control station (AGCS), umbilical tower, and launcher area. See figure 1-1 for a block diagram of the three systems.

The ECS receives gaseous nitrogen (GN_2) from the nitrogen storage facility (volume IV) and ambient air from a remote air intake. The ECS conditions and distributes the selected medium to the various vehicle compartments and launcher areas.

The GN_2 deluge purge system provides a low-temperature, inert environment in the S-I stage engine compartment in the event of a launch cancellation.

The water quench system supplies water to the S-I stage engine compartment in the event of a fire within the compartment.

Author

1.2 ENVIRONMENTAL CONTROL SYSTEM

Three conditioning units (figure 1-1), each with the capability of cooling air or GN_2, route the selected medium through individual control units where the temperature of the medium is regulated to the required level.

Air is supplied to the conditioning units from the remote air intake; GN_2 is supplied from the nitrogen storage facility (volume IV). The required medium, air or GN_2, is selected at controls in the LCC, and the conditioning units refrigerate, dehumidify, and deliver the selected medium to the control units. Each conditioning unit is capable of delivering a flow rate of 300 pounds per minute through two passages, across the evaporator coils, and into the control units. Passage "A" has a capacity flow rate of 100 pounds per minute, and passage "B" has a capacity flow rate of 200 pounds per minute. The evaporator cools and dehumidifies the medium. The control unit then heats the medium to the temperature required by the vehicle and delivers it through damper-controlled ducts to the umbilical tower and into the vehicle compartments.

Heat removed from the medium during the cooling cycle is transferred from the refrigerant to water in the condenser-receiver. The water is then circulated to the water cooling tower where the heat is dissipated to the atmosphere.

The major components of the ECS are discussed in order of function as related to the flow of the medium.

1.2.1 Remote Air Intake (Figure 3-3) - The remote air intake supplies filtered ambient air to the conditioning units at a static pressure equal to 3.0 inches of water. The intake is located away from the launcher area to avoid the induction of contaminants into the system. The unit consists of a supply fan, a filter, a pneumatic controller, and a vortex damper.

Air is drawn in through an input screen, Filter A4209, and Vortex Damper A4210 by Supply Fan A4211. Air pressure equal to a static pressure of three inches of water is maintained at the input to the conditioning units by Pneumatic Controller A4088. The controller places pressure on a diaphragm actuator which positions the vortex damper and regulates the air flow. High Pressure Switch A4367 or Low Pressure Switch A4358 will actuate if an abnormal condition occurs. The actuated pressure switch transmits a signal to an indicator located on the LCC control panel.

1.2.2 Conditioning Units - Three basically identical conditioning units are located on the roof of the AGCS. The conditioning units cool and dehumidify the air or GN_2 and deliver the selected medium to the control units. The air or GN_2 output from the conditioning units is maintained at a static pressure equal to 55 inches of water.

Since the conditioning units are similar, only conditioning unit A-3 (figure 3-3) and associated controls are described. Conditioning unit A-3 operates with control unit D to supply a conditioned medium to the S-I stage engine compartment and to the launcher area.

1.2.2.1 Pneumatic Control Pressure. GN_2 at 8 psig and 20 psig is used to actuate the pneumatic control components of the conditioning units. GN_2 at 50 psig is supplied to the ECS from valve panel No. 5 (volume V). The GN_2 supply passes through Filter A4316 (figure 3-1) to Pressure Regulator A4270 where the pressure is reduced to 8 psig. The 8-psig GN_2 is supplied to Solenoid Valves A4102 and A4103 (figure 3-3) which control Ball Dampers A4248 and A4249.

The 50-psig GN_2 input to the ECS also passes through Filter A4317 and Pressure Regulator A4269 (figure 3-1). The pressure is reduced in the regulator to 20 psig and is then routed to Booster Regulators A4325 and A4326 (figure 3-3), Pneumatic Controllers A4250, A4251, and A4371, and Solenoid Valves A4095 and A4096. The 8- and 20-psig GN_2 control pressures are monitored at Pressure Gages A4319 and A4318 (figure 3-1), respectively.

1.2.2.2 Air or GN_2 Flow (Figure 3-3). Air on GN_2 may be selected by operating the AIR/GN_2 selector switch located in the LCC. With the selector switch set to the AIR position, Solenoid Valves A4102 and A4103 energize and cause Ball Dampers A4248 and A4249 to open. Air from the remote air intake enters the conditioning unit through Air Filters A4107 and A4108. At the same time, Solenoid Valves A4095 and A4096 deenergize and cause Flow Regulators A4097 and A4098 to close and block GN_2 flow. Blowers A4099 and A4101, operated by Motor A4100, draw the air in and force the air

across Evaporator Coils A4105 and A4370 at a static pressure equal to approximately 57 inches of water. The conditioned air then flows through passages "A" and "B" to the control unit.

When the AIR/GN_2 selector switch is set to the GN_2 position, Solenoid Valves A4095 and A4096 are energized and Solenoid Valve A4102 and A4103 are deenergized. The deenergized solenoid valves return to the normally open position and Ball Dampers A4248 and A4249 inflate to stop air flow into the unit. The energized Solenoid Valves A4095 and A4096 cause Flow Regulators A4097 and A4098 to open. GN_2 from the nitrogen storage facility then flows through Manual Valve A4271 and Filter A4334 (figure 3-1), the flow regulators, and into the conditioning unit. Blower A4099 and A4101, operated by Motor A4100, draw in GN_2 and force it across Evaporator Coils A4105 and A4370 at a static pressure equal to approximately 57 inches of water. The conditioned GN_2 flows out of the conditioning unit into the control unit.

The air or GN_2 medium is cooled in the evaporator by transferring heat from the medium to the R-22 refrigerant flowing through the evaporator coils. Excess moisture in the air or GN_2 condenses in the evaporator and drops into a drip pan located in the bottom of the evaporator housing. When the water reaches a preset depth, a float trap actuates and the collected water flows to a drain. The cooled and dehumidified air or GN_2 flows to the control unit.

1.2.2.3 R-22 Refrigerant Flow (Figure 3-3). The R-22 refrigerant flows through the evaporator in a closed-loop mechanical circuit. Liquid R-22 refrigerant flows from Condenser-Receiver A4061 through Manual Valves A4065 and A4068, and Filter A4070. The flow is then through Manual Valve A4067, by Sightglass A4397, through Heat Exchanger A4391, Solenoid Valve A4071 and Sightglass A4104, to Thermal Expansion Valves A4090 and A4094. From the expansion valves, the refrigerant flows into the evaporator where it absorbs heat from the air or GN_2 flowing across the evaporator coils. The R-22 vapors then flow past Temperature Sensors A4087 and A4092, through Flow Regulator A4089, Heat Exchanger A4391 and Manual Valve A4082, to Compressor A4079. The compressed refrigerant vapor flows through Manual Valve A4081 and is then distributed into three branches: (1) through Manual Valve A4273, through control unit Reheat Coils A4221 and A4223, past Temperature Controllers A4220 and A4225, through Flow Regulators A4222 and A4224, and Manual Valves A4272 and A4062 to Condenser-Receiver A4061; (2) through Flow Regulator A4078 and into the compressor suction line where it maintains a constant load on the compressor; and (3) through Pressure Regulator A4075 and Manual Valve A4062 into the condenser-receiver, where the vapor is condensed. The refrigerant vapors are condensed in the condenser-receiver by the cooling action of water circulating through the condenser coils. Water flow is controlled by Pneumatic Valve A4059.

Maintenance and servicing of Filter A4070 is accomplished by opening bypass Manual Valve A4069 and closing Manual Valves A4067 and A4068. The refrigerant lines can be purged by opening Manual Valves A4066 and A4374.

The function of system components in the refrigeration cycle is as follows:

a. Evaporator. The evaporator contains primary Evaporator Coil A4370 and secondary Evaporator Coil A4105. Each coil is fed by a thermal expansion valve

and is separate from the other coil. Heat from the medium flowing across the coils is absorbed by the refrigerant flowing through the coils. The liquid refrigerant vaporizes and is then routed to the compressor.

b. Thermal Expansion Valves A4094 and A4090. The thermal expansion valves regulate the flow rate of R-22 refrigerant entering the evaporator. Thermal Expansion Valves A4094 and A4090 are controlled by Temperature Sensors A4092 and A4087, respectively. The sensors monitor the temperature of R-22 vapor leaving the coil, and control valve opening to maintain the temperature of the R-22.

During conditions of low flow, only one thermal expansion valve is required to accurately control the flow of R-22. The other expansion valve is deactivated. Temperature Switch A4361 and Temperature Sensor A4362 actuate at temperatures below 105 F and energize Solenoid Valve A4093, which causes Thermal Expansion Valve A4090 to close. This action deactivates the secondary evaporator circuit and increases the load on Thermal Expansion Valve A4094. The valve will then operate at a higher flow rate with increased temperature sensitivity.

c. Flow Regulator A4089. The flow regulator maintains the temperature of air or GN_2 leaving the evaporator to approximately 40 F by regulating the pressure of R-22 in the evaporator coils. The rate of heat absorption by the R-22 depends on the temperature difference between air or GN_2 and the R-22 boiling point. The boiling temperature of R-22 is directly related to its pressure. Decreasing the regulator opening increases the pressure of R-22 and increases the amount of heat absorbed by the refrigerant. Increasing the regulator opening reduces the amount of heat absorbed. The regulator is controlled by GN_2 pressure from Temperature Controller A4086. The opening of the controller is proportional to the temperature of air or GN_2 sensed by Thermistor A4076.

d. Compressor A4079. The compressor is an unloaded-start, reciprocating, suction-gas cooled, sealed unit that has positive pressure lubrication. The unit compresses R-22 refrigerant vapors and circulates the high-pressure vapors to the control unit, the condenser-receiver, and the hot-gas bypass regulator. The refrigerant vapors flowing to the compressor flow across the motor windings and cool the compressor motor. A heater in the crankcase maintains the oil reservoir temperature above ambient to prevent refrigerant accumulation. The accumulation of liquid refrigerant in the crankcase could damage the compressor upon resumption of operation after shutdown periods.

Differential Pressure Switch A4091 in the lubricating oil line protects the compressor against loss of oil pressure. A time-delay switch allows the compressor to operate for approximately 90 seconds to establish a pressure differential and to allow time for suspended oil in the system to return to the crankcase. If the required pressure differential is not established within 90 seconds, or if pressure is lost for 90 seconds, Differential Pressure Switch A4091 will actuate

and the compressor will stop. The differential pressure switch is equipped with a manual reset button. Pressure Switch A4085 will stop the compressor if the discharge pressure is excessive, or if the suction line pressure is insufficient. Compressor discharge Manual Valve A4081 and compressor suction Manual Valve A4082 permit the compressor to be isolated from the remainder of the system. Manual Valves A4084 and A4083 allow isolation of Pressure Gages A4275 and A4274, respectively.

e. Flow Regulator A4078. The flow regulator prevents the compressor from being overloaded. This eliminates the requirement for compressor cycling or cylinder unloading.

A pilot valve within the regulator senses pressure changes in the compressor suction line caused by the throttling of Flow Regulator A4089. The pilot valve opens or closes accordingly to operate the main part of the valve, allowing the required amount of hot discharge gas to flow back to the compressor suction line. This keeps a constant load on the compressor and prevents cavitation. When the main blower control circuits are deenergized, the normally closed hot-gas bypass Solenoid Valve A4077 is deenergized. Liquid shutoff Solenoid Valve A4071 prevents leakage of liquid R-22 refrigerant to other parts of the system when the system is shut down. The valve is controlled by safety interlock Pressure Switch A4394. The valve opens when the blower starts, and closes when the blower stops.

f. Desuperheater Valve A4106. The desuperheater valve controls the temperature of the R-22 refrigerant in the compressor suction line by injecting controlled amount of liquid R-22 into the suction line. This prevents the compressor from overheating.

g. Pressure Regulator A4075. The pressure regulator forces hot R-22 refrigerant gas to flow to the control unit reheat coils. The regulator maintains the compressor discharge pressure approximately 10 psig higher than the condenser-receiver inlet pressure. The pressure differential forces the gas through the reheat coils and back to the condenser-receiver.

h. Condenser-Reciever A4061. The hot compressed gases are changed into a liquid in the condenser section of the condenser-receiver. The unit then stores the liquid in the receiver section which has the capacity to hold the entire R-22 refrigerant charge when the conditioning unit is shut down. The condenser-receiver receives the hot, gaseous, R-22 refrigerant from the reheat coil. Water from Water Cooling Tower A4379 (figure 3-1) reduces the temperature of the R-22 to its dew point and the condensate is stored in the receiver for recycling. Water flow through the condenser-receiver is described in paragraph 1.2.4. Relief Valve A4064 relieves condenser pressure at 350 psig. Manual Valve A4063 may be used to vent or purge the refrigerant side of the condenser. Manual Valves A4062 and A4065 are used to isolate the condenser for maintenance purposes. Refrigerant charging Manual Valve A4066 is used to add R-22 to the system.

i. Filter A4070. The filter removes moisture and foreign particles from the R-22 refrigerant charge. The filter may be removed or replaced without losing the R-22 charge by closing Manual Valves A4067 and A4068. A by-pass line and Manual Valve A4069 permit the filter to be changed while the system is operating.

j. Indicators. Sightglass A4397 provides a visual means of detecting moisture in the refrigerant charge. Sightglass A4104 is used to check whether or not the refrigerant charge is adequate.

1.2.3 Control Units - The control units receive preconditioned air or GN_2 at 40 F and heat the medium to the temperature required by the particular compartment which the unit services. The control units use hot R-22 refrigerant flowing through a reheat coil to heat the air or GN_2. An electric heater aids in heating the medium to the temperature required for distribution to the S-I stage engine compartment when the reheat coil has reached the maximum temperature output.

Since the control units are similar, only control unit D (figure 3-3) is described. Control unit D operates with conditioning unit A-3 to supply a conditioned medium to the S-I stage engine compartment and to the launcher area.

Reheat Coil A4221 uses R-22 refrigerant vapor to heat air or GN_2 to a maximum of 85 F. The R-22, after circulating through the reheat coil, returns to the condenser-receiver in the conditioning unit. R-22 may be vented from the system by opening Manual Valve A4374.

Temperature of the air or GN_2 leaving the control unit is regulated by controlling the flow of R-22 refrigerant through the reheat coil. A thermistor in the engine and launcher compartments transmits a continuous temperature signal to Temperature Controllers A4220 and A4225. The controllers actuate the motor-drive mechanism for Flow Regulators A4222 and A4224 respectively. Operation of the flow regulators throttles R-22 refrigerant flow through the reheat coil to maintain temperature in the engine and launcher compartments.

When the engine compartment temperature requirement exceeds the capability of the reheat coil, Electric Heater A4246 is energized. The heater has the capacity to heat the medium for the S-I stage engine compartment to 210 F. Each of the electric heaters has three fixed-capacity heating elements which are sequentially energized as required to maintain the medium at the desired temperature.

When Flow Regulator A4222 completely opens, indicating the reheat coil capacity has been reached, a limit switch closes and energizes the motor on a cam-operated switch assembly. The motor rotates and causes a contactor on the switch to close. This action energizes one of the three heater elements. The motor continues to operate and cam action keeps the contactor closed. If one heating element satisfies the temperature controller, the limit switch opens and the motor stops. Flow Regulator A4222 will then modulate to control refrigerant flow. If additional heat is required, the limit switch actuates and the motor will drive to the next position and energize the

second heater element. If the flow regulator fully closes, a second limit switch is actuated. This causes the motor to reverse direction and sequentially deenergize the heater elements.

The capacity of the reheat coil exceeds the capacity of any single heating element. This feature allows the reheat coil to provide modulating temperature control and the electric heaters to supplement the reheat coil as required.

Over-Temperature Cutout Switch A4349 deenergizes the electric heater when the sensed temperature exceeds the preset value for the control unit. The switch will reenergize the heaters when the temperature decreases 50 F below the preset value.

1.2.4 Water System - Water at ambient temperature is used to cool the hot R-22 refrigerant gases in the condenser-receivers. The water is pumped from Water Cooling Tower A4379 (figure 3-1) to the condenser-receiver of each conditioning unit. Manual Valves in the input and output lines to each condenser-receiver permit each unit to be isolated for maintenance. An orifice in each condenser-receiver bypass line balances the water flow to each unit and compensates for differences in plumbing. The following paragraphs describe the major components in detail. Because the condenser-receivers are similar, only the condenser-receiver in Conditioning Unit A3, A4332 (figure 3-3) is described.

1.2.4.1 Water Cooling Tower A4379 (Figure 3-1). The water cooling tower consists of an aerating system of trays, a blower, and a catch-basin. The hot water enters the tower at the top. Spray pipes and a tier of trays break up the water and Blower Motor A4053 forces ambient air through the resulting spray to cool the spray as it falls into the catch-basin. Float Valve A4052 maintains the basin water level by admitting make-up water through Manual Valve A4050. Manual Valve A4150 permits blow-down to keep mineral deposits out of the system; the valve must be opened whenever the system is operated. The basin may be drained through Manual Valve A4051 when required. Pump A4054 draws cool water from the catch basin and pumps it through Check Valve A4320 to the condenser-receivers of the conditioning units.

1.2.4.2 Condenser-Receiver Water Regulation (Figure 3-3). Cooling water is admitted to the condenser-receiver through isolating Manual Valve A4057. Water flow through the condenser-receiver is regulated by Pneumatic Valve A4059. The pneumatic valve is differential-pressure operated and controls flow through the condenser-receiver by diverting part of the flow through a bypass line. A 20-psig GN_2 reference pressure is supplied to one side of the valve and a 5- to 15- psig GN_2 control pressure is supplied to the other side. The control pressure is proportional to the operating pressure inside the condenser-receiver and controls the opening of the bypass port of Pneumatic Valve A4059. Initially, condenser-receiver pressure is zero and the pneumatic valve is in full bypass position, resulting in minimal water flow into the condenser-receiver. As the pressure increases, the bypass port closes proportionately to progressively increase the flow of cooling water into the condenser-receiver. This action continues until the system stabilizes and flow through the condenser-receiver is approximately equal to the bypass flow. Orifice A4060 balances full bypass flow around Condenser-Receiver A4061 with full bypass flow around the other condenser-receivers. Manual Valve A4058

functions as a water service valve and as a vent for the condenser-receiver. Manual Valve A4058 is also used to drain the water from the condenser-receiver when required. Pneumatic Controller A4371 adjusts the pressure of the 20-psig GN_2 supply in accordance with the internal pressure of Condenser-Receiver A4061. This fluctuating pressure is supplied to Pneumatic Valve A4059 to regulate the flow of cooling water to the condenser-receiver. The heated water from the condenser-receiver is routed back to the cooling tower through isolating Manual Valve A4056.

1.2.5 Distribution Ducts - Eight ducts conduct conditioned air or GN_2 from the environmental control units to the umbilical tower. Because the ducts and related components operate in a similar manner, only the flow through one duct from control unit D (figure 3-3) is described.

The conditioned air or GN_2 from control unit D flows through Venturi A4308 where the flow is monitored by Differential Pressure Transducer A4306 and Differential Pressure Switch A4381. The transducer transmits a signal that is read out as flow rate in the LCC. The pressure switch will shut down the conditioning unit if the flow rate is insufficient. The medium flows from the venturi through motor-operated Damper A4307 and Check Valve A4352, to the S-I stage engine compartment manifold. The damper, controlled from the LCC, regulates the flow of the medium.

1.2.6 S-I Stage Engine Compartment Conditioning - The S-I stage engine compartment receives conditioned air or GN_2 from control unit D (figure 3-3) at a pressure equal to 55 inches of water. The medium flows from the duct to Pneumatic Valve A4342 (figure 3-4). When Solenoid Valves A4387 and A4388 are energized, the medium flows through the opened pneumatic valve to Pneumatic Valves A4903 and A4908. Solenoid Valves A4904 and A4905 are then energized to open Pneumatic Valves A4903 and A4908, respenctively. The flow through Pneumatic Valve A4903 passes through Manual Valves A4339 and A4340, Quick-Disconnect Couplings A4343, A4344, and B502, and into the distribution manifolds. The flow through Pneumatic Valve A4908 passes through Manual Valves A4347 and A4348, Quick-Disconnect Couplings A4345, A4346, and B502, and inot the distribution manifolds. The conditioned medium maintains the temperature of the compartment to approximately 60 F. The manual valves are adjusted to balance the flow through the distribution manifolds.

1.2.7 S-I Stage Forward Instrument Compartments Conditioning - The conditioning medium for the S-I stage forward instrument compartments flows from control unit B (figure 3-1) through the duct and Quick-Disconnect Couplings A3058 and B320 (figure 3-4) into the distribution manifolds. The medium is vented from the instrument compartments through a return line and Quick-Disconnect Coupling B321. The medium maintains the temperature of the compartments between 80 and 85 F.

1.2.8 S-IV Stage Engine Compartment Conditioning - The conditioning medium for the S-IV stage engine compartment flows from control unit C (figure 3-2) through the ducts and Transition Assembly A4398 (figure 3-4) to the manifold. Thermistor E59 monitors the temperature. The temperature of the compartment is maintained between 150 and 157 F.

1.2.9 Instrument Unit Compartment and S-IV Forward Interstage Conditioning - The conditioning medium flows from control unit B (figure 3-1) through Transition Assembly A3282 (figure 3-4) to the instrument unit compartment. Temperature in the compartment is maintained between 40 F and 60 F.

The conditioning medium for the S-IV forward interstage flows from control unit B (figure 3-1) through Transition Assembly A3281 (figure 3-4) to the S-IV forward interstage compartment. Temperature in the compartment is maintained as required by action of Electric Heater A4241, (figure 3-1) located in control unit B.

1.2.10 ECS Control - The ECS is operated by control equipment located in the LCC and the AGCS. The control equipment includes devices which control and monitor the operation of the ECS. The AGCS controls are used for operation of the ECS while the vehicle is being checked out and tested. The LCC controls are used during launch operations. Since the following paragraphs describe the operation of the ECS during a launch sequence, only the LCC controls are described.

Two ECS control racks in the LCC consist of twelve panels containing system starting controls, air or GN_2 temperature controls and indicators, flow rate controls and indicators, and malfunction indicators.

1.2.10.1 System Control Panel. The SYSTEM CONTROL panel contains the following controls:

a. D. C. POWER ON/OFF switch - Controls application of all dc power to the system.

b. System START pushbutton - Starts the system.

c. System STOP pushbutton - Shuts down the system.

d. AIR/GN_2 switches (4) - Selects the conditioning medium supplied to the vehicle compartments and launcher area.

1.2.10.2 Compartment Temperature Control Panels. The compartment temperature control panels contain controls and indicators for setting and monitoring the vehicle compartment temperatures. There are seven panels, one for each compartment. The controls, indicators,and their function are as follows:

a. COMPARTMENT TEMPERATURE Gage - Indicates the temperature of either the vehicle compartment, or the duct leading to the compartment, depending on the location of the sensor.

b. TEMP. SELECTOR - Presets the temperature the automatic circuit will control.

c. MANUAL/AUTO Switch - Deenergizes the automatic control circuit to allow manual control of the compartment temperature.

d. TEMPERATURE CONTROL VALVE POSITION Gage - Indicates the degree of opening of the flow regulator.

e. INCREASE/DECREASE Switch-Operates the flow regulator to increase or decrease the flow of refrigerant through the control unit reheat coils when the MANUAL/AUTO switch is in the MANUAL position.

f. FLOW CONTROL Gage - Indicates the flow rate of the air or GN_2 through the duct.

g. FLOW CONTROL INCREASE/DECREASE Switch - Operates the motor-driven damper in the duct to increase or decrease the flow rate of the air or GN_2.

.2.10.3 Conditioned Gas Temp. - Evaporator Disch. Panel. The CONDITIONED GAS TEMP. - EVAPORATOR DISCH. panel contains gages for monitoring the temperature of the conditioned medium leaving each conditioning unit evaporator. There is one gage for each passage through the evaporator.

a. PAYLOAD/BLOWER "A" Gage - Indicates the temperature of the air or GN_2 leaving the evaporator of conditioning unit A-1 through passage "A". Passage "A" services the payload forward and aft compartments.

b. INST. UNIT - S-I FORWARD/BLOWER "B" Gage - Indicates the temperature of the air or GN_2 leaving the evaporator of conditioning unit A-1 through passage "B". Passage "B" services the S-I stage instrument compartments.

c. S-IV Engine Blower "A" Gage - Indicates the temperature of the air or GN_2 leaving the evaporator of conditioning unit A-2 through passage "A". Passage "A" is not presently in operation.

d. S-IV ENGINE/BLOWER "B" - Indicates the temperature of the air or GN_2 leaving the evaporator of conditioning unit A-2 through passage "B". Passage "B" services the S-IV stage engine compartment.

e. S-I ENGINE -LAUNCHER/BLOWER "A" Gage - Indicates the temperature of the air or GN_2 leaving the evaporator of conditioning unit A-3 through passage "A". Passage "A" services the launcher compartment.

f. S-I ENGINE-LAUNCHER/BLOWER "B" Gage - Indicates the temperature of the air or GN_2 leaving the evaporator of conditioning unit A-3 through passage "B". Passage "B" services the S-I stage engine compartment.

1.2.10.4 Intake Air - Nitrogen Purge Panel. The INTAKE AIR - NITROGEN PURGE panel contains controls for the operation of the remote air intake. The controls are as follows:

a. INTAKE AIR BLOWER CONTROL/SLOW Button - Starts the remote air intake fan at slow speed.

b. INTAKE AIR BLOWER CONTROL/FAST Button - Starts the remote air intake fan at fast speed.

c. STOP Button - Stops the remote air intake fan.

1.2.11 ECS Operation - Initially all circuit breakers, switches. and selectors are set to the normal operating positions. The D. C. POWER switch on the SYSTEM CONTROL panel is placed to ON position. The INTAKE AIR BLOWER CONTROL/FAST button

located on the INTAKE AIR - NITROGEN PURGE panel is pressed to energize the remote air intake fan.

1.2.11.1 System Starting. The system is ready for operation after the preliminary functions have been performed. The SYSTEM START button on the SYSTEM CONTROI panel is pressed to initiate the starting sequence.

When the SYSTEM START button is pressed, a lock-in relay in the AGCS will energize the cooling tower pump and fan. When the pump and fan reach operating speed, a switch is closed which actuates a sequence controller in the AGCS. The sequence controller is a motor-driven switch bank that starts the conditioning units in sequence to minimize the starting current surge.

1.2.11.2 Air or GN_2 Temperature Control. The temperature of the air or GN_2 delivered to a particular compartment is determined by the setting of the TEMP. SELECTOR control on the compartment temperature control panel. A sensing probe detects the temperature of the compartment and transmits a monitoring signal to the LCC. A difference between the detected temperature and the selected temperature causes Flow Regulators A4222 and A4224 (figure 3-3) to actuate accordingly. If the automatic control circuit should fail, a manual circuit can be activated by placing the MANUAL/AUTO switch to the MANUAL position. This allows the flow regulators to be controlled by the INCREASE/DECREASE switch. Placing the switch in the INCREASE position opens the regulator further, thereby increasing the temperature of the compartment. Placing the switch in the DECREASE position reverses the action. The TEMPERATURE CONTROI VALVE POSITION gage indicates the degree of regulator opening.

Figure 1-2 illustrates the temperature profile of the various conditioning operations performed on the air or GN_2 flow.

1.2.11.3 Air or GN_2 Flow Control (Figure 3-3). When air is the required conditioning medium, the AIR/GN_2 selector switch for the conditioning unit is set to the AIR position. With the selector switch in this position, normally open Solenoid Valves A4102 and A4103 and normally closed Solenoid Valves A4095 and A4096 are energized. Closing Solenoid Valves A4102 and A4103 blocks the 8-psig GN_2 control pressure to Ball Dampers A4248 and A4249 and vents the dampers. This action allows air from the fresh air intake to flow into the passages. Simultaneously, Solenoid Valves A4095 and A4096 are energized and 20-psig GN_2 control pressure is applied to the actuator of Pneumatic Controllers A4250 and A4251. This shuts off the control pressure to Booster Regulators A4325 and A4326 and causes the 20-psig control pressure to be applied to Flow Regulators A4097 and A4098 and the flow of GN_2 is blocked.

When GN_2 is the required conditioning medium, the AIR/GN_2 selector switch is set to the GN_2 position. This causes Solenoid Valves A4102 and A4103 to deenergize and the 8-psig GN_2 control pressure flows through to inflate Ball Dampers A4248 and A4249 and block the flow of air. At the same time, Solenoid Valves A4095 and A4096 are deenergized. This action removes the 20-psig GN_2 control pressure and applies downstream blower pressure to the actuator of Pneumatic Controllers A4250 and

A4251. The pneumatic controllers then modulate the 20-psig GN_2 control pressure to the actuators of Booster Regulators A4325 and A4326. The booster regulators in turn control the pressure to operate Flow Regulators A4097 and A4098. An increase or decrease of the downstream blower pressure causes the pressure regulators and booster regulators to modulate the flow regulators and maintain a static pressure equal to 57 inches of water downstream of the blowers in passages "A" and "B". Passage "A" and passage "B" in Conditioning Unit A-1, A4328 (figure 3-1), can be operated independently. In this unit, passage "A" may have GN_2 flowing while passage "B" may have air flowing. However, in the other conditioning units, the same medium must flow in both passages.

1.2.11.4 Evaporator Refrigerant Regulation (Figure 3-3). Flow Regulator A4089 controls the flow of vaporous R-22 refrigerant from the evaporator to the compressor. A 20-psig GN_2 control pressure supplied to Temperature Controller A4086 is controlled by a signal from Thermistor A4076 that corresponds to the temperature of the air or GN_2 leaving the evaporator. The output of the controller actuates the flow regulator and throttles the refrigerant flow to the compressor. The throttling action of the regulator in turn controls the temperature of the R-22 refrigerant.

1.2.11.5 Condenser Water Regulation (Figure 3-3). Water regulator Pneumatic Valve A4059 controls the flow of water through the condenser-receiver. GN_2 control pressure at 20 psig is supplied to Pneumatic Controller A4371. A pressure signal from the condenser-receiver causes the pneumatic controller to vary the GN_2 supply. The varying GN_2 output of the pneumatic controller is supplied to Pneumatic Valve A4059 as control pressure and causes the pneumatic valve to throttle the water circulating through the condenser-receiver.

1.3 GN_2 DELUGE PURGE SYSTEM

The GN_2 deluge purge system (figure 3-4) provides a high volume supply of GN_2 at 50 psig to the S-I engine compartment in the event of a malfunction that causes engine shutdown. The purge provides a cool, inert atmosphere to reduce the possibility of fire. The GN_2 deluge purge system consists of the deluge purge panel, control valves, and distribution manifolds.

The deluge purge panel receives 3000-psig GN_2 from the pneumatic control distributor (volume V). The GN_2 flows to dome-loaded Pressure Regulator A2255 and to Pressure Regulator A2252 past Pressure Gage A2251. Pressure Regulator A2252 reduces the pressure to 50 psig for loading Pressure Regulator A2255. From Pressure Regulator A2252, the GN_2 flows past Pressure Gage A2261 to Solenoid Valve A2254. Manual Valve A2262 permits venting through Pneumatic Silencer A2266. When a deluge purge command is given, Solenoid Valve A2254 is energized and Solenoid Valves A4387 and A4388 are deenergized. The normally open port of Solenoid Valve A4388 closes Pneumatic Valve A4342 to isolate the GN_2 deluge purge system from the ECS. Solenoid Valve A2254 allows the reference pressure to flow through Orifice A2253 to the dome of Pressure Regulator A2255. The regulator opens and reduces 3000-psig GN_2 to 50 psig in accordance with the reference pressure. The 50-psig GN_2 then flows past Shuttle Valve A2263, Pressure Switch A2256, and Pressure Gage A2258 into the distribution manifolds. The purge supply then branches and flows to Pneumatic Valves A4903 and A4908. When Solenoid Valves A4905 are energized, Pneumatic Valves

A4903 and A4908, respectively, are opened. From Pneumatic Valve A4903, the GN_2 flows through Manual Valves A4339 and A4340, Quick-Disconnect Couplings A4343 and B502, and Quick-Disconnect Couplings A4344 and B502 into the S-I stage engine compartment. From Pneumatic Valve A4908, the GN_2 flows through Manual Valves A4347 and A4348, Quick-Disconnect Couplings A4345 and B502, and Quick-Disconnect Couplings A4346 and B502 into the S-I stage engine compartment.

1.4 WATER QUENCH SYSTEM

The water quench system (figure 3-4) supplies water at 125 psig to the S-I stage engine compartment and is used only in the event of a fire. The water quench system consists of valves and controls to admit water through the same distribution lines and manifolds used for environmental conditioning and GN_2 deluge purge. The water quench system uses 750-psig GN_2 from the launcher manifold as a control pressure. Operation of the system is manually initiated in the LCC upon receipt of a signal from the fire detection system within the engine compartment. When the signal is initiated, Solenoid Valves A4904 and A4905 are deenergized to close Pneumatic Valves A4903 and A4908, respectively. Simultaneously, the Solenoid Valves A4902 and A4906 are energized and allow 750-psig GN_2 control pressure to open Pneumatic Valves A4901 and A4909, respectively. Water then flows at 125 psig through the open pneumatic valves, Manual Valves A4339, A4340, A4347, and A4348, Quick-Disconnect Couplings A4343, A4344, A4345 and A4346, and four Quick-Disconnect Couplings B502. The water is uniformly distributed through the manifolds to quench the fire and cool the engine compartment.

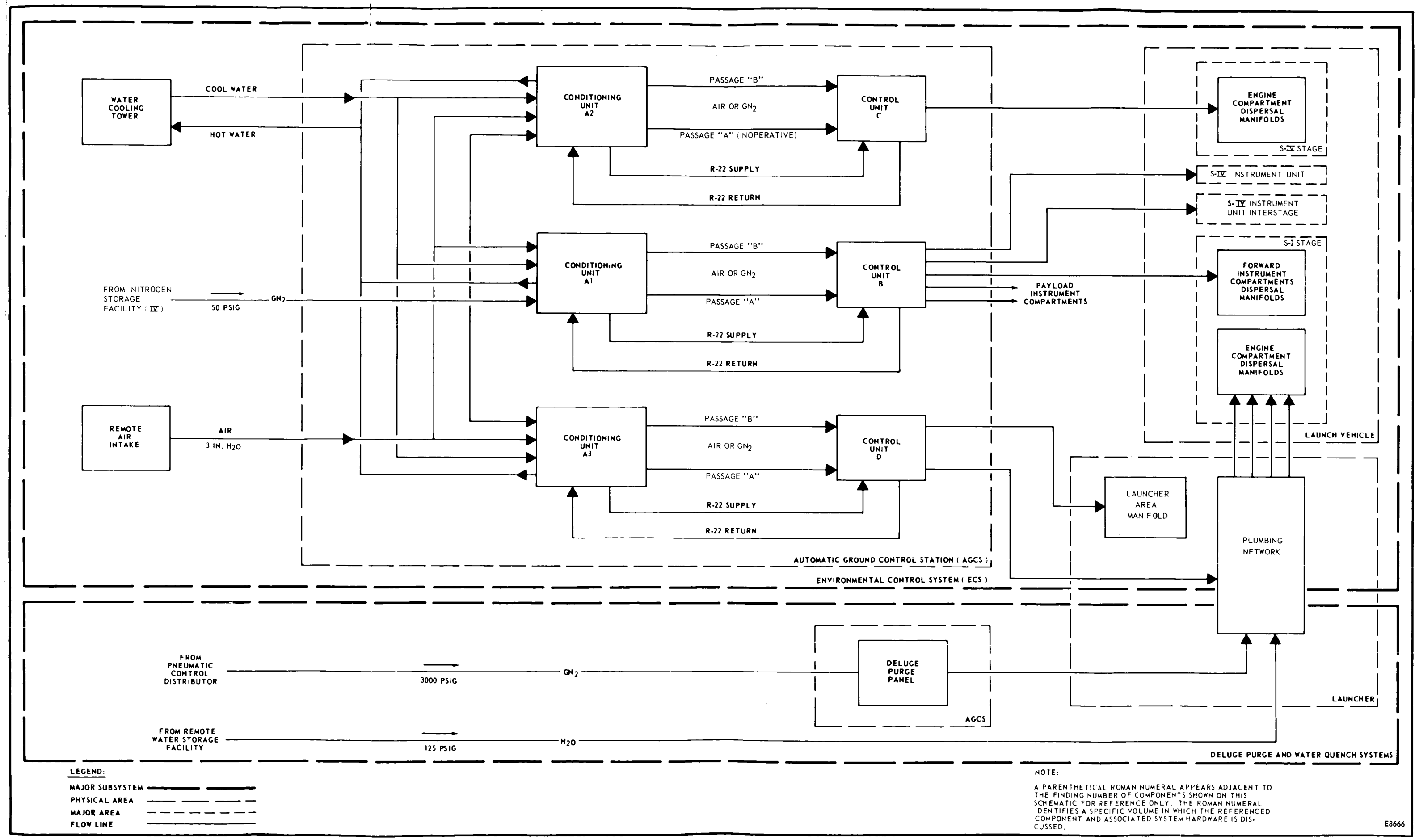

Figure 1-1. Environmental Conditioning Systems-Block Diagram

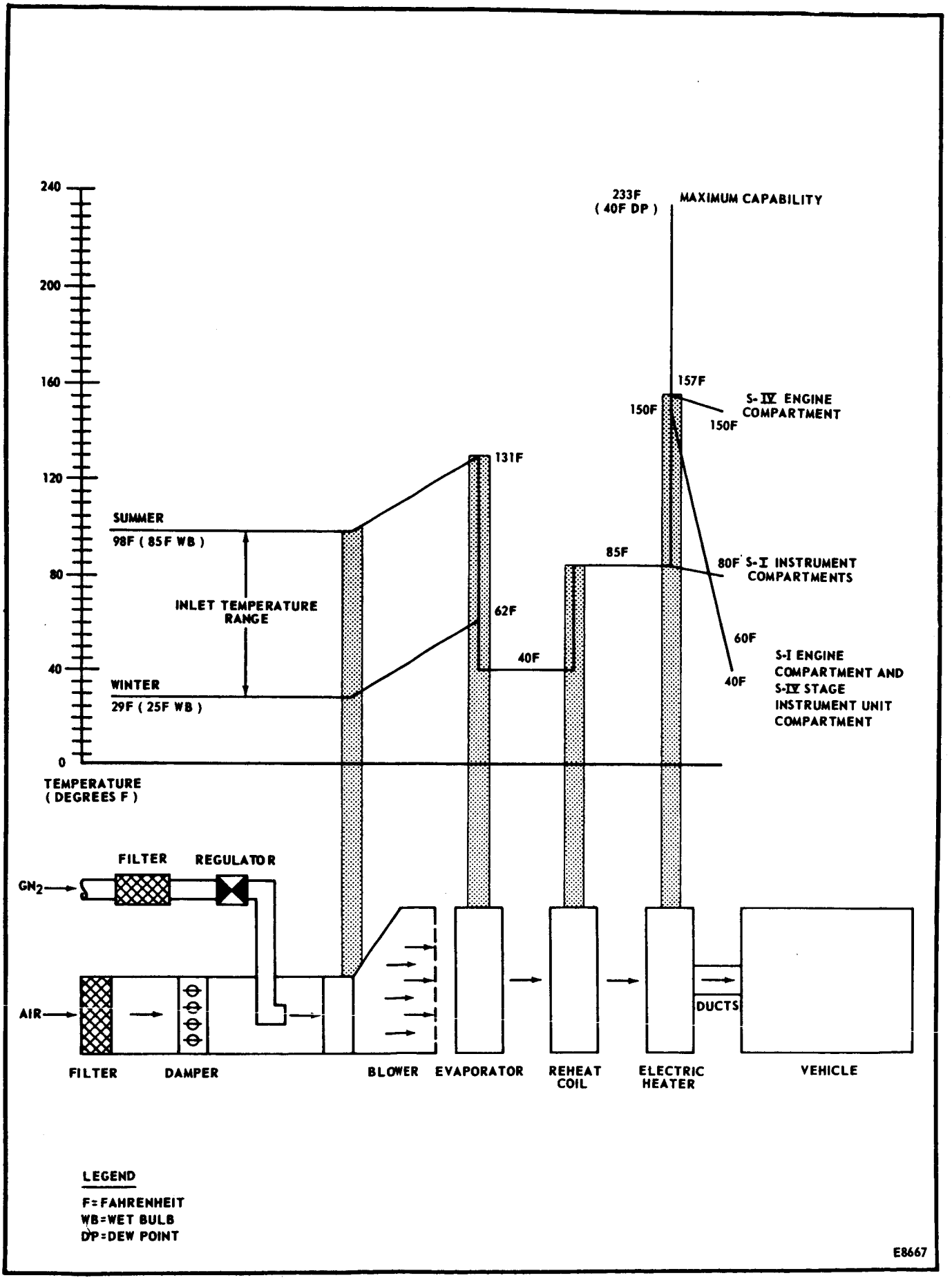

Figure 1-2. Temperature Profile of ECS

SECTION 2

INDEX OF FINDING NUMBERS

This section contains an alpha-numerical list, by finding number, of the environmental conditioning systems components that function during a prelaunch countdown or in the event of a launch abort. The finding numbers listed identify components on system mechanical schematics provided in section 3. Additional columns in the index of finding numbers provide such pertinent information as component description and function, part number, and the supplier's name and part number. A break will occur in the alpha-numeric sequence of finding numbers when a component, or component series is non-functional during the countdown, functional only in the event of a malfunction, functional in terms of a maintenance operation only, or is part of another functional system.

The letter prefix of a finding number identifies the component location with respect to either the launch complex or an area of the launch vehicle. The letter prefixes used in this eleven-volume set are listed below.

FINDING NUMBER PREFIX	DESIGNATED AREA
A	Launch complex
B	S-I stage
E	S-IV stage
G	Instrument unit
H	Payload

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A2251	1	Gage, Pressure	0- to 5000-psig range, 3000-psig normal indication	Marsh Instrument Co. P/N 210 3SSFMH	75M50147-15	
A2252	1	Regulator, Pressure	3150 (± 50) -psig inlet, 50 (± 5) -psig outlet	Wallace O. Leonard Inc. P/N 146050-34	10437835	
A2253	1	Orifice	0.031 (+ 0.002, - 0.001)-in. dia	Rocketdyne P/N 9504-45062	10430000	
A2254	1	Valve, Solenoid	NC	Marotta Valve Corp. P/N 202873-113(MV-74)	75M01351	55A4A1
A2255	1	Regulator, Pressure	3150 (± 50)-psig inlet, 50 (± 5)-psig outlet; deluge purge line	Grove Valve & Reg. Co. P/N 10977A087B	75M50341-3	
A2256	1	Switch, Pressure	Actuates at 20 (± 0.5) psig, deactuates at 1.5 psig below actuation pressure	Southwestern Ind. Inc. P/N PS3704-20	10434297-5	
A2257	1	Valve, Relief	Relieves at 100 (± 5) psig, reseats at 85 psig	Fluid Mechanics Co. P/N 2-1084	10430216-9	
A2258	1	Gage, Pressure	0- to 160-psig range, 50-psig normal indication	Marsh Instrument Co. P/N 210-CSFMH	75M50147-5	
A2259 and A2260 are not functionally applicable to this system.						
A2261	1	Gage, Pressure	0- to 160-psig range, 50-psig normal indication	Marsh Instrument Co. P/N 210-CSFMH	75M50147-5	
A2262	1	Valve, Manual	1/4 in., vent	Robbins Aviation P/N SSNA-250-4T-787	75M01305-1	
A2263	1	Valve, Shuttle	1/4 in.	Clary Corp. P/N 52400-3	10434448	

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A2264	1	Nipple		Snaptite Inc. P/N SPHN-4-4-56	75M50183	
A2265	1	Cap, Dust		Snaptite Inc. P/N SDCH-4	75M50181-1	
A2266	1	Silencer, Pneumatic	3/8 in.	C. W. Morris Co. P/N AA-3	1043141-2	
A2267	1	Valve, Relief	Relieves at 140 (±5) psig, reseats at 126 psig	James-Pond-Clark Co. P/N 5159T1-4TB-140	10430079	
A2268 through A3057 are not functionally applicable to this system.						
A3058	1	Coupling Quick-Disconnect			75M02015	
A3059 through A3280 are not functionally applicable to this system.						
A3281	1	Transition Assembly			75M06696	
A3282	1	Transition Assembly			75M07028	
A3283 through A4049 are not functionally applicable to this system.						
A4050	1	Valve, Manual	1-1/2 in., make-up water shutoff	Lunkenheimer Co. P/N 123		
A4051	1	Valve, Manual	3 in., water drain	Lunkenheimer Co. P/N 123		

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A4052	1	Valve, Float	Float-operated fill	Baltimore Aircoil Co. Inc. P/N 50-390SA		
A4053	1	Motor, Blower	Cooling tower fan	Baltimore Aircoil Co. Inc. P/N TM175		182B2
A4054	1	Pump	Water circulating	Allis Chalmers Mfg. Co. P/N 5X4-L-C3		181B1
A4055	1	Valve, Manual	1/4 in., condenser-receiver vent	Lunkenheimer Co. P/N 123		
A4056	1	Valve, Manual	Condenser-receiver water shutoff			
A4057	1	Valve, Manual	Condenser-receiver water shutoff			
A4058	1	Valve, Manual	1/4 in., condenser-receiver vent	Lunkenheimer Co. P/N 123		
A4059	1	Valve, Pneumatic	3-way, water regulator	Minneapolis-Honeywell Regulator Co. P/N V5013A		
A4060	1	Orifice	Water flow balancing			
A4061	1	Condenser-Receiver	Vapor to liquid converter	The Trane Co. P/N CDS-153		
A4062	1	Valve, Manual	2-1/8-in. -O D- flange, condenser-receiver refrigerant shutoff	Mueller Brass Co. P/N A15168		
A4063	1	Valve, Manual	1/2 in., shutoff	Superior Valve and Fittings Co. P/N 605-8D		

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A4064	1	Valve, Relief	Condenser-receiver pressure relief	The Trane Co. P/N CDS-153		
A4065	1	Valve, Manual	Condenser-receiver refrigerant shutoff	The Trane Co. P/N CDS-153		
A4066	1	Valve, Manual	1/4 in., R-22 refrigerant charge	Kerotest Mfg. Co. P/N R-224-X1		
A4067	1	Valve, Manual	1-5/8-in. -OD flange, filter shutoff	Superior Valve and Fittings Co. P/N 193-15S		
A4068	1	Valve, Manual	1-5/8-in. -OD flange, filter shutoff	Superior Valve and Fittings Co. P/N 193-15S		
A4069	1	Valve, Manual	1-5/8-in. -OD flange, filter bypass	Superior Valve and Fittings Co. P/N 193-15S		
A4070	1	Filter	1-5/8-in. core	Sporlan Valve Co. P/N C19213W/RC 4864		
A4071	1	Valve, Solenoid	1-5/8-in. -OD flange, NC; refrigerant flow	Sporlan Valve Co. Type 100-S		181A3L2
A4072	1	Orifice	Passage "B" of Conditioning unit A-1			
A4073	1	Orifice	Passage "B" of Conditioning unit A-3			
A4074 is not functionally applicable to this system.						
A4075	1	Regulator, Pressure	3 in., differential pressure	Fisher Governor Co. P/N 644-AR		

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A4076	1	Thermistor	Thermal sensing element for evaporator pressure regulator	Minneapolis-Honeywell Regulator Co. P/N L7022A-1002	Part of 10717	181A3RT8
A4077	1	Valve, Solenoid	3/8 in., hot gas bypass	Sporlan Valve Co. Type 10S		181A3L1
A4078	1	Regulator, Flow	0- to 80-psig range pilot, 1-5/8-OD-flange, hot-gas bypass	Alco Valve Co. P/N HGR-15H		
A4079	1	Compressor	R-22 refrigerant	Dunham-Bush Inc. P/N B10-H, Type 61AU		181A3B22
A4080	1	Thermistor	Thermal sensing element for evaporator pressure	Minneapolis-Honeywell Regulator Co. P/N L7022A-1002		181A2RT8
A4081	1	Valve, Manual	Compressor output shutoff	Dunham-Bush Inc. P/N B10-H, Type 61AU	Part of 10704	
A4082	1	Valve, Manual	Compressor suction line shutoff	Dunham-Bush Inc. Part of P/N B10-H, Type 61AU		
A4083	1	Valve, Manual	1/4 in., pressure gage shutoff	Mueller Brass Co. P/N A-14838		
A4084	1	Valve, Manual	1/4 in., pressure gage shutoff	Mueller Brass Co. P/N A-14838		
A4085	1	Switch, Pressure	Compressor safety switch, actuates on high and low pressure	Penn. Controls Inc. P/N 4DP2#271		181A3S50
A4086	1	Controller, Temperature	NC, electrically-operated	Minneapolis-Honeywell Regulator Co. P/N RP7904A MK IV		181A3TC9
A4087	1	Sensor, Temperature				

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A4088	1	Controller, Pneumatic	Air intake damper positioner			
A4089	1	Regulator, Flow	4 in., pneumatically-operated	Minneapolis-Honeywell Regulator Co. Series 800, Type 12		
A4090	1	Valve, Thermal Expansion	1-1/8-in. x 1-5/8 in. - OD flange, evaporator secondary circuit	Sporlan Valve Co. P/N MVE-42		
A4091	1	Switch, Differential Pressure	Oil pressure failure	Penn. Controls Inc. P/N 2D5-275A010		181A3S49
A4092	1	Sensor, Temperature	Sensor bulb in evaporator output			
A4093	1	Valve, Solenoid	3-way, NC; evaporator coil cutoff	Sporlan Valve Co. P/N Type 180		181A3L3
A4094	1	Valve, Thermal Expansion	1-1/8-in. x 1-5/8-in. OD-flange, evaporator primary circuit	Sporlan Valve Co. P/N MVE - 34		
A4095	1	Valve, Solenoid	3/32-in. orifice; 3-way, NC; 20-psig GN_2 control pressure	Automatic Switch Co. Cat. No. 83147		181A3A1L7
A4096	1	Valve, Solenoid	3/32-in orifice; 3-way, NC; 20-psig GN_2 control pressure	Automatic Switch Co. Cat. No. 83147		181A3A1L5
A4097	1	Regulator, Flow	6 in., pneumatic-operated, 50-psig GN_2 supply	Mason-Neilan Div. P/N 137-3		
A4098	1	Regulator, Flow	4 in., pneumatic-operated, 50-psig GN_2 supply	Mason-Neilan Div. P/N 137-3		
A4099	1	Blower	Air or GN_2 supply	Buffalo-Forge Co. P/N CB-40-4		

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A4100	1	Motor	Blower motor	Buffalo Forge Co.		181A3B21
A4101	1	Blower	Air or GN_2 supply	Buffalo Forge Co. P/N CB40-3		
A4102	1	Valve, Solenoid	1/2 in.; 3-way, N. O.; 8-psig GN_2 control pressure	Automatic Switch Co. P/N 8300 A74-G		181A3A1L4
A4103	1	Valve, Solenoid	1/2 in.; 3-way, N. O.; 8-psig GN_2 control pressure	Automatic Switch Co. P/N 8300 A74-G		181A3A1L6
A4104	1	Sightglass	Refrigerant flow	Superior Valve and Fittings Co. P/N 823-15ST		
A4105	1	Coil, Evaporator	Secondary circuit	Dunham-Bush Inc. P/N 10701		
A4106	1	Valve, Desuperheater	Electrically-operated flow control valve	Sporlan Valve Co. P/N PVE-18-C		
A4107	1	Filter, Air	Fresh air supply	Farr Co. P/N B-20753 Type 44 Special		
A4108	1	Filter, Air	Fresh air supply	Farr Co. P/N B-20753 Type 44 Special		
A4109	1	Valve, Manual	Condenser-receiver water shutoff			
A4110	1	Valve, Manual	1/4 in., condenser-receiver vent	Lunkenhiemer Co. P/N 123		
A4111	1	Valve, Pneumatic	3-way, water regulator	Minneapolis-Honeywell Regulator Co. P/N V5013A		

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A4112	1	Orifice	Flow balancing			
A4113	1	Valve, Manual	2-1/8-in.-OD-flange, condenser-receiver shutoff	Mueller Brass Co. P/N A15168		
A4114	1	Valve, Manual	1/2 in., condenser purge	Superior Valve and Fittings Co. P/N 605-8D		
A4115	1	Valve, Relief	Condenser-receiver pressure relief	The Trane Co. Part of P/N CDS-153		
A4116	1	Valve, Manual	Condenser-receiver shutoff	The Trane Co. Part of P/N CDS-153		
A4117	1	Condenser-Receiver	Condenses vapors to liquid	The Trane Co. Part of P/N CDS-153		
A4118	1	Filter	1-5/8-in. core	Sporlan Valve Co. P/N C-19213W/RC4864		
A4119	1	Valve, Manual	1-5/8-in.-OD flange, filter bypass	Superior Valve and Fittings Co. P/N 193-15S		
A4120	1	Valve, Manual	1-5/8-in.-OD flange, filter shutoff	Superior Valve and Fittings Co. P/N 193-15S		
A4121	1	Valve, Manual	1-5/8-in.-OD flange, filter shutoff	Superior Valve and Fittings Co. P/N 193-15S		
A4122	1	Regulator, Pressure	3 in., differential pressure	Fisher Governor Co. P/N 644-AR		
A4123	1	Regulator, Flow	1-5/8-in.-OD flange; 0 to 80-psig range; hot gas bypass	Alco Valve Co. P/N HGR-15H		

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A4124	1	Valve, Solenoid	3/8 in.; NC; hot gas bypass	Sporlan Valve Co. Type 10S		181A2L1
A4125	1	Valve, Desuperheater	Electrically-operated flow control valve	Sporlan Valve Co. P/N PVE-18-C		
A4126	1	Compressor	R-22 refrigerant	Dunham-Bush Inc. P/N B10-H, Type 61AU		181A2B22
A4127	1	Regulator, Flow	4 in., pneumatically-operated	Minneapolis-Honeywell Regulator Co. Series 800, Type 12		
A4128	1	Valve, Manual	Compressor output shutoff	Dunham-Bush Inc. Part of P/N B10-H, Type 61AU		
A4129	1	Valve, Manual	Compressor suction shutoff	Dunham-Bush Inc. Part of P/N B10-H, Type 61AU		
A4130	1	Valve, Manual	1/4 in., pressure gage shutoff	Mueller Brass Co. P/N A-14838		
A4131	1	Valve, Manual	1/4 in., pressure gage shutoff	Mueller Brass Co. P/N A-14838		
A4132	1	Controller, Temperature	NC, electrically-operated	Minneapolis-Honeywell Regulator Co. P/N RP7904A MK IV		181A2A1-TC9
A4133	1	Sensor, Temperature	Sensing bulb in evaporator output			
A4134	1	Valve, Thermal Expansion	1-1/8-in. x 1-5/8-in.-OD flange, evaporator secondary circuit	Sporlan Valve Co. P/N MVE-42		
A4135 is not functionally applicable to this system.						

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A4136	1	Sightglass	Refrigerant flow	Superior Valve and Fittings Co. P/N 823-15ST		
A4137	1	Valve, Solenoid	3-way, NC	Sporlan Valve Co. Type 180		181A2L3
A4138	1	Valve, Solenoid	3/32-in. orifice; 3-way, NC; 20-psig GN_2 control pressure	Automatic Switch Co. Cat. No. 83147		181A2A1L7
A4139	1	Valve, Solenoid	3/32-in. orifice; 3-way, NC; 20-psig GN_2 control pressure	Automatic Switch Co. Cat. No. 83147		181A2A1L5
A4140	1	Regulator, Flow	6 in., 50-psig GN_2 input supply	Mason-Neilan Div. Model 137-3		
A4141	1	Regulator, Flow	4 in., 50-psig GN_2 input supply	Mason-Neilan Div P/N 137-3		
A4142	1	Blower	Air or GN_2 supply	Buffalo Forge Co. P/N CB-40-4		
A4143	1	Motor	Blower motor, 405 vdc	Buffalo Forge Co. P/N CB-40-3		
A4144	1	Blower	Air or GN_2 supply	Buffalo Forge Co. P/N CB-40-3		
A4145	1	Valve, Solenoid	1/2-in.; 3-way, N. O. ; 8-psig GN_2 control pressure	Automatic Switch Co. P/N 8300 A74-G		181A2A1L4
A4146	1	Filter Air	Fresh air input	Farr Co.		
A4147	1	Valve, Solenoid	1/2-in.; 3-way, N. O. 8-psig GN_2 control pressure	Automatic Switch Co. P/N 8300 A74-G		181A2A1L6

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A4148	1	Filter, Air	Fresh air input	Farr Co. P/N B20753		
A4149	1	Coil, Evaporator	Secondary circuit	Dunham-Bush Inc. P/N 10701		
A4150	1	Valve, Manual	Blowdown			
A4151	1	Valve, Thermal Expansion	1-1/8-x 1-5/8-in. -OD flange primary circuit	Sporlan Valve Co. P/N MVE-34		
A4152	1	Valve, Manual	1/4 in., condenser-receiver vent	Lunkenheimer Co. P/N 123		
A4153	1	Valve, Manual	Condenser-receiver inlet water shutoff			
A4154	1	Valve, Manual	Condenser-receiver outlet water shutoff			
A4155	1	Valve, Manual	1/4 in., condenser-receiver vent	Lunkenheimer Co. P/N 123		
A4156	1	Valve, Pneumatic	3-way, water regulator	Minneapolis-Honeywell Regulator Co. P/NV 5013A		
A4157	1	Orifice	Flow balancing			
A4158	1	Condenser-Receiver		The Trane Co. P/N CDS-153		
A4159	1	Filter-Drier	1-5/8-in. core	Sporlan Valve Co. P/N C19213 W/RC4864		

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A4160	1	Valve, Manual	2-1/8-in. -OD flange, condenser-receiver refrigerant shutoff	Mueller Brass Co. P/N 15168		
A4161	1	Valve, Manual	1/2 in., condenser-receiver vent	Superior Valve and Fittings Co. P/N 605-8D		
A4162	1	Valve, Relief		The Trane Co. Part of P/N CDS-153		
A4163	1	Valve, Manual	Condenser-receiver refrigerant shutoff	The Trane Co. Part of P/N CDS-153		
A4164	1	Valve, Manual	1-5/8-in. -OD flange, filter shutoff	Superior Valve and Fittings Co. P/N 193-15S		
A4165	1	Valve, Manual	1-5/8-in. -OD flange, filter shutoff	Superior Valve and Fittings Co. P/N 193-15S		
A4166	1	Valve, Manual	Filter bypass	Superior Valve Co. Fittings Co. P/N 193-15S		
A4167	1	Valve, Desuperheater	Electrically-operated flow control valve	Sporlan Valve Co. P/N PVE-18-C		
A4168	1	Compressor	R-22 refrigerant	Dunham-Bush Inc. P/N B10-H, Type 61AU		181A1B22
A4169	1	Regulator, Differential Pressure	3 in., refrigerant flow control	Fisher Governor Co. P/N 644-AR		
A4170	1	Regulator, Flow	1-5/8-in. -OD flange; 0 to 80-psig range pilot; hot gas bypass flow control	Alco Valve Co. P/N HGR-15H		
A4171	1	Valve, Solenoid	3/8 in.; NC; hot gas bypass	Sporlan Valve Co. Type 105		181A1L1

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A4172	1	Valve, Manual	Compressor discharge shutoff	Dunham-Bush Inc. Part of P/N B10-H, Type 61AU		
A4173	1	Valve, Manual	Compressor suction shutoff	Dunham-Bush Inc. Part of P/N B10-H, Type 61AU		
A4174	1	Valve, Manual	Gage shutoff	Mueller Brass Co. P/N A-14838		
A4175	1	Controller, Temperature	Electrically-operated, 20-psig GN_2 control pressure	Minneapolis-Honeywell Regulator Co. P/N RP 7904A MK IV		181A1A1-TC9
A4176	1	Sensor, Temperature	Sensing bulb in evaporator primary circuit			
A4177 and A4178 are not functionally applicable to this system.						
A4179	1	Valve, Solenoid	3-way, NC, refrigerant	Sporlan Valve Co. Type 180		181A1L3
A4180	1	Sensor, Temperature	Sensing bulb in evaporator secondary circuit			
A4181	1	Sightglass	Refrigerant flow	Superior Valve and Fittings Co. P/N 823-15ST		
A4182	1	Valve, Thermal Expansion	1-1/8-in. x 1-5/8-in.-OD flange secondary circuit	Sporlan Valve Co. P/N MVE-34		
A4183	1	Valve, Solenoid	3-way, NC, GN_2 control pressure	Automatic Switch Co. Cat. No. 83147		181A1A-1L7
A4184	1	Valve, Solenoid	3-way, NC, GN_2 control pressure	Automatic Switch Co. Cat. No. 83147		181A1A-1L5

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A4185	1	Regulator, Flow	50-psig GN_2 supply	Mason-Neilan Div. Model 137-3		
A4186	1	Regulator, Flow	50-psig GN_2 supply	Mason-Neilan Div. P/N 137-3		
A4187	1	Blower	Air or GN_2	Buffalo Forge Co. P/N CB-40-4		
A4188	1	Blower	Air or GN_2	Buffalo Forge Co. P/N CB-40-3		
A4189	1	Filter, Air	Fresh air supply	Farr Co. P/N B-20753, Type 44 Special		
A4190	1	Filter, Air	Fresh air supply	Farr Co. P/N B-20753 Type 44 Special		
A4191	1	Valve, Solenoid	1/2 in.; 3-way, N. O. ; 8-psig GN_2 control pressure	Automatic Switch Co. P/N 8300 A74-G		181A1A1L4
A4192	1	Valve, Solenoid	1/2 in.; 3-way, N. O.; 8-psig GN_2 control pressure	Automatic Switch Co. P/N 8300 A74-G		181A1A1L6
A4193	1	Coil, Evaporator	Secondary circuit	Dunham-Bush Inc. P/N 10701		
A4194	1	Thermistor	Thermal sensing element for evaporator pressure regulator	Minneapolis-Honeywell Regulator Co. P/N L7022A-1002		181A1RT8
A4195	1	Valve, Solenoid	1-5/8-in. -OD flange, NC, refrigerant flow	Sporlan Valve Co. Type 100S		181A2L2
A4196	1	Valve, Solenoid	1-5/8-in. -OD flange, NC, refrigerant flow	Sporlan Valve Co. Type 100S		

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A4197	1	Coil, Reheat	Air or GN_2	Dunham-Bush Inc. P/N 10705		
A4198	1	Controller, Temperature	Reheat coil	Imperial Electronics Inc. P/N 1146-100		181A4A-2TC4
A4199	1	Regulator, Flow	Motor-operated	Minneapolis-Honeywell Regulator Co. Model 1407 W/M930B		181A4B7
A4200	1	Coil, Reheat	Air or GN_2	Dunham-Bush Inc. P/N 10705		
A4201	1	Controller, Temperature	Reheat coil	Imperial Electronics Inc. P/N 1146-100		181A4A-2TC5
A4202	1	Regulator, Flow	Motor-operated	Minneapolis-Honeywell Regulator Co. Model 1407 W/M 930B		181A4B13
A4203	1	Coil, Reheat	Air or GN_2	Dunham-Bush Inc. P/N 10705		
A4204	1	Controller, Temperature	Reheat coil	Imperial Electronics Inc. P/N 1146-100		181A4A-2TC6
A4205	1	Regulator, Flow	Motor-operated	Minneapolis-Honeywell Regulator Co. Model 1407 W/M 930B		
A4206	1	Coil, Reheat	Air or GN_2	Dunham-Bush Inc. P/N 10705		
A4207	1	Controller, Temperature	Reheat coil	Imperial Electronics Inc. P/N 1146-100		181A4A-TC7
A4208	1	Regulator, Flow	Motor-operated	Minneapolis-Honeywell Regulator Co. Model 1407 W/M 930B		181A4B17

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A4209	1	Filter	Air intake			
A4210	1	Damper, Vortex	Air intake			
A4211	1	Fan, Supply	Air intake			
A4212	1	Thermistor				
A4213	1	Thermistor				
A4214	1	Thermistor				
A4215	1	Controller, Temperature		Imperial Electronics Inc. P/N 1146-100		181A5A-2TC3
A4216	1	Coil, Reheat		Dunham-Bush Inc. P/N 10706		
A4217	1	Regulator, Flow	Motor-operated	Minneapolis-Honeywell Regulator Co. Model 1407 W/M930B		181A5B6
A4218 is not functionally applicable to this system.						
A4219	1	Control, Reheater				
A4220	1	Controller, Temperature	Reheat coil	Imperial Electronics Inc. P/N 1146-100		181A6A-2TC2

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A4221	1	Coil, Reheat	Air or GN_2	Dunham-Bush Inc. P/N 10707		
A4222	1	Regulator, Flow	Motor-operated	Minneapolis-Honeywell Regulator Co. Model 1407 W/M 930B		
A4223	1	Coil, Reheat		Dunham-Bush Inc. P/N 10707		
A4224	1	Regulator, Flow	Motor-operated	Minneapolis-Honeywell Regulator Co. Model 1407 W/M 930B		181A6B2
A4225	1	Controller, Temperature	Reheat coil	Imperial Electronics Inc. P/N 1146-100		181A6A-2TC1
A4226	1	Thermistor		Imperial Electronics Inc. P/N 1151-100		181S12
A4227 through A4232 are not functionally applicable to this system.						
A4233	1	Coil, Reheat		Dunham-Bush Inc.		
A4234	1	Controller, Temperature		Imperial Electronics Inc. P/N 1146-100		181A4TC8
A4235	1	Regulator, Flow	Motor-operated	Minneapolis-Honeywell Regulator Co. Model 1407 W/M 930B		181A4B24
A4236	1	Valve, Check				
A4237	1	Damper	Motor-operated	Minneapolis-Honeywell Regulator Co. P/N M630A		181B25

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A4238	1	Orifice				
A4239	1	Transducer, Differential pressure		Foxboro Co. P/N 613 DL-LK2		181MT8
A4240	1	Switch, Differential Pressure		F. W. Dwyer Co. Model 1627-12		
A4241	1	Heater, Electric				181A4HR20
A4242	1	Switch, Thermal,	Overtemperature			
A4243 is not functionally applicable to this system.						
A4244	1	Motor	Blower motor, 405 vdc	Buffalo Forge Co. P/N CB40-3		181A1B21
A4245	1	Heater, Electric	Air or GN_2	Heat Engineering and Supply Co. P/N 1302-10		181A5HR1 181A5HR2 181A5HR3
A4246	1	Heater, Electric	Air or GN_2	Heat Engineering and Supply Co. P/N 1302-10		
A4247 is not fucntionally applicable to this system.						
A4248	1	Damper, Ball	Air-flow shutoff, bladder-actuated	Air Factors Inc. P/N S-8-9000		
A4249	1	Damper, Ball	Air-flow shutoff, bladder-actuated	Air Factors Inc. P/N S-8-9000		

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A4250	1	Controller, Pneumatic	20-psig GN_2 control pressure	Mason-Neilan Div. P/N 2717		
A4251	1	Controller, Pneumatic	20-psig GN_2 control pressure	Mason-Neilan Div. P/N 2717		
A4252	1	Controller, Pneumatic	20-psig GN_2 control pressure	Mason-Neilan Div. P/N 2717		
A4253	1	Controller, Pneumatic	20-psig GN_2 control pressure	Mason-Neilan Div. P/N 2717		
A4254	1	Damper, Ball	Air-flow shutoff, bladder-actuated	Air Factors Inc. P/N S-8-9000		
A4255	1	Damper, Ball	Air-flow shutoff, bladder-actuated	Air Factors Inc. P/N S-8-9000		
A4256 and A4257 are not functionally applicable to this system.						
A4258	1	Switch, Differential Pressure	Oil pressure failure	Penn. Controls Inc. Code 2D5, Type 275AP10		181A2A1-S49
A4259 is not functionally applicable to this system.						
A4260	1	Controller, Pressure	20-psig GN_2 control pressure	Mason-Neilan Div. P/N 2717		
A4261	1	Controller, Pressure	20-psig GN_2 control pressure	Mason-Neilan Div. P/N 2717		
A4262	1	Damper, Ball	Air-flow shutoff, bladder-actuated	Air Factors Inc. P/N S-8-9000		

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A4263	1	Damper Ball	Air-flow shutoff, bladder-actuated	Air Factors Inc. P/N S-8-9000		
A4264 through A4266 are not functionally applicable to this system.						
A4267	1	Switch, Differential Pressure	Oil pressure failure	Penn. Controls Inc. Code 2D5, Type 275AP10		181A1A1-S49
A4268 is not functionally applicable to this system.						
A4269	1	Regulator, Pressure	20-psig GN_2 control pressure	Mason-Neilan Div. Model 71		
A4270	1	Regulator, Pressure	8-psig GN_2 control pressure	Mason-Neilan Div. Model 71		
A4271	1	Valve, Manual	12 in., 50-psig GN_2 supply shutoff	Keystone Valve Corp.		
A4272	1	Valve, Manual	1-1/8-in.-OD flange, refrigerant shutoff	Superior Valve and Fittings Co. P/N 191-11ST		
A4273	1	Valve, Manual	1-1/8-in.-OD flange, refrigerant shutoff	Superior Valve and Fittings Co. P/N 191-11ST		
A4274	1	Gage, Pressure	4-1/2-in. dial, compressor output	Marsh Instrument Co. P/N 1 FMRB		
A4275	1	Gage, Pressure	4-1/2-in. dial, compressor suction	Marsh Instrument Co. P/N 3 FMRB		
A4276	1	Valve, Manual	1-1/8-in.-OD flange, refrigerant shutoff	Superior Valve and Fittings Co. P/N 191-11ST		

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A4277	1	Valve, Manual	1-1/8-in.-OD flange, refrigerant shutoff	Superior Valve and Fittings Co. P/N 191-11ST		
A4278	1	Gage, Pressure	4-1/2-in. dial, compressor output	Marsh Instrument Co. P/N 1 FMRB		
A4279	1	Switch, Pressure	Compressor safety switch, actuates on high and low pressure	Penn. Controls Inc. Code 4DP2 Type 271AP12AN		181A2A1-S50
A4280	1	Valve, Manual	1-1/8-in.-OD flange, refrigerant shutoff	Superior Valve and Fittings Co. P/N 191-11ST		
A4281	1	Valve, Manual	1-1/8-in.-OD flange, refrigerant shutoff	Superior Valve and Fittings Co. P/N 191-11ST		
A4282	1	Gage, Pressure	4-1/2-in. dial, compressor output	Marsh Instrument Co. P/N 1 FMRB		
A4283	1	Switch, Pressure	Compressor safety switch, actuates on high and low pressure	Penn. Controls Inc. Code 4DB2, Type 271AP12AN		
A4284	1	Gage, Pressure	4-1/2-in. dial	Marsh Instrument Co. P/N 3 FMRB		
A4285	1	Valve, Manual	1/4-in.-OD flange, gage shutoff	Mueller Brass Co. P/N A-14838		
A4286	1	Regulator, Flow	Pneumatically-operated	Minneapolis-Honeywell Regulator Co. Series 800, Type 12		
A4287	1	Thermistor	Temperature indicating	Imperial Electronics Inc. P/N 1149-100		181A3RT6
A4288	1	Thermistor	Temperature indicating	Imperial Electronics Inc. P/N 1149-100		181A3RT7

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A4289	1	Valve, Thermal Expansion	1-1/8-in. by 1-5/8-in.-OD flange, secondary circuit	Sporlan Valve Co. P/N MVE-42		
A4290 is not functionally applicable to this system.						
A4291	1	Transducer, Differential Pressure	Air or GN_2	Foxboro Co. P/N 613 DL-LK2		181MT4
A4292	1	Venturi	Air or GN_2			
A4293	1	Valve	Motor-operated damper	Minneapolis-Honeywell Regulator Co. P/N M630A		181B16
A4294	1	Transducer, Differential Pressure	Air or GN_2	Foxboro Co. P/N 613DL-LK2		181MT3
A4295	1	Venturi	Air or GN_2			
A4296	1	Damper	Motor-operated	Minneapolis-Honeywell Regulator Co. P/N M630A		181B14
A4297	1	Venturi	Air or GN_2			
A4298	1	Damper	Motor-operated	Minneapolis-Honeywell Regulator Co. P/N M630A		181B11
A4299	1	Transducer, Differential Pressure	Air or GN_2	Foxboro Co. P/N 613DL-LK2		181MT5
A4300	1	Orifice				

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A4301	1	Damper	Motor-operated	Minneapolis-Honeywell Regulator Co. P/N M630A		181B12
A4302	1	Transducer, Differential Pressure	Air or GN_2	Foxboro Co. P/N 613DL-LK2		181MT7
A4303	1	Orifice	Air or GN_2			
A4304	1	Damper	Motor-operated	Minneapolis-Honeywell Regulator Co. P/N 630A		181B4
A4305	1	Transducer, Differential Pressure	Air or GN_2	Foxboro Co. P/N 613DL-LK2		181MT2
A4306	1	Transducer, Differential Pressure	Air or GN_2	Foxboro Co. P/N 613DL-LK2		181MT6
A4307	1	Damper	Motor-operated	Minneapolis-Honeywell Regulator Co. P/N 630A		181B9
A4308	1	Venturi	Air or GN_2			
A4309	1	Orifice	Air or GN_2			
A4310	1	Damper	Motor-operated	Minneapolis-Honeywell Regulator Co. P/N 630A		181B1
A4311	1	Transducer, Differential Pressure	Air or GN_2	Foxboro Co. P/N 613DL-LK2		181MT1
A4312	1	Thermistor	Temperature indicating	Imperial Electronics Inc.		181A3RT6

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A4313	1	Thermistor	Temperature indicating	Imperial Electronics Inc.		181A3RT7
A4314	1	Thermistor	Temperature indicating	Imperial Electronics Inc.		181A2RT6
A4315	1	Thermistor	Temperature indicating	Imperial Electronics Inc.		181A2RT7
A4316	1	Filter	50-psig GN_2 control pressure	Mason-Neilan Div. Model 61		
A4317	1	Filter	50-psig GN_2 control pressure	Mason-Neilan Div. Model 61		
A4318	1	Gage, Pressure	20-psig GN_2 control pressure	Mason-Neilan Div. Model 71		
A4319	1	Gage, Pressure	8-psig GN_2 control pressure	Mason-Neilan Div. Model 71		
A4320	1	Valve, Check	4 in., water supply	Lunkenheimer Co. P/N 1790		
A4321	1	Regulator, Booster	GN_2 control pressure to flow control regulator	Mason-Neilan Div. P/N 972142-4 Cat. No. 20113		
A4322	1	Regulator, Booster	GN_2 control pressure to flow control regulator	Mason-Neilan Div. P/N 972142-4 Cat. No. 20113		
A4323	1	Regulator, Booster	GN_2 control pressure to flow control regulator	Mason-Neilan Div. P/N 972142-4 Cat. No. 20113		
A4324	1	Regulator, Booster	GN_2 control pressure to flow control regulator	Mason-Neilan Div. P/N 972142-4 Cat. No. 20113		

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A4325	1	Regulator, Booster	GN_2 control pressure to flow control regulator	Mason-Neilan Div. P/N 972142-4 Cat. No. 20113		
A4326	1	Regulator, Booster	GN_2 control pressure to flow control regulator	Mason-Neilan Div. P/N 972142-4 Cat. No. 20113		
A4327	1	Control Unit	Unit B			181A4
A4328	1	Conditioning Unit	Unit A-1			181A1
A4329	1	Control Unit	Unit C			181A5
A4330	1	Conditioning Unit	Unit A-2			181A2
A4331	1	Control Unit	Unit D			181A6
A4332	1	Conditioning Unit	Unit A-3			181A3
A4333	1	Switch, Pressure	Low GN_2 pressure	Minneapolis-Honeywell Regulator Co. P/N P668A-1038-1		181S21a
A4334	1	Filter	50-psig GN_2 supply	Permanent Filter Corp. P/N 18394-5		
A4335	1	Switch, Temperature	50-psig GN_2 supply	Minneapolis-Honeywell Regulator Co. P/N T675A-1029		181S18a
A4336	1	Gage, Pressure	4-1/2-in. dial, compressor suction	Marsh Instrument Co. P/N 3FMRB		

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A4337	1	Valve, Manual	1/4 in., refrigerant charge	Kerotest Mfg. Co. P/N R-224-XL		
A4338	1	Valve, Manual	1/4 in., refrigerant charge	Kerotest Mfg. Co. P/N R-224-XL		
A4339	1	Valve, Manual	Deluge purge shutoff			
A4340	1	Valve, Manual	Deluge purge shutoff			
A4341 is not functionally applicable to this system.						
A4342	1	Valve, Pneumatic	12 in., conditioned-air/GN_2 flow control	Keystone Valve Corp.		
A4343	1	Coupling, Quick-Disconnect			75M02200	
A4344	1	Coupling, Quick-Disconnect			75M02200	
A4345	1	Coupling, Quick-Disconnect			75M02200	
A4346	1	Coupling, Quick-Disconnect			75M02200	
A4347	1	Valve, Manual	Butterfly, water quench			
A4348	1	Valve, Manual	Butterfly, water quench			

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A4349	1	Switch, Over-Temperature Cutout				181A6A-2S8
A4350	1	Switch, Over-Temperature Cutout				181A5A-2S20
A4351	1	Valve, Check	Air or GN_2	Lunkenheimer Co. P/N 1790		
A4352	1	Valve, Check	Air or GN_2	Lunkenheimer Co. P/N 1790		
A4353	1	Valve, Check	Air or GN2	Lunkenheimer Co. P/N 1790		
A4354	1	Valve, Check	Air or GN_2	Lunkenheimer Co. P/N 1790		
A4355	1	Valve, Check	Air or GN_2	Lunkenheimer Co. P/N 1790		
A4356	1	Valve, Check	Air or GN_2	Lunkenheimer Co. P/N 1790		
A4357	1	Valve, Check	Air or GN_2	Lunkenheimer Co. P/N 1790		
A4358	1	Switch, Pressure	Fresh air intake, low pressure	Minneapolis-Honeywell Regulator Co. P/N C645A-1006-1		181S19a
A4359	1	Valve, Manual	1/4 in., condenser-receiver drain	Lunkenheimer Co. P/N 123		
A4360	1	Valve, Manual	Condenser-receiver water shutoff			

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A4361	1	Switch, Temperature	Thermostat	Minneapolis-Honeywell Regulator Co. P/N T675A-1060		181A3A-1S51
A4362	1	Sensor, Temperature	Air or GN_2			
A4363	1	Switch, Temperature	Thermostat	Minneapolis-Honeywell Regulator Co. P/N T675A-1060		181A2A-1S51
A4364	1	Sensor, Temperature	Air or GN_2			
A4365	1	Switch, Temperature	Thermostat	Minneapolis-Honeywell Regulator Co. P/N T675A-1060		181A1-A1S51
A4366	1	Sensor, Temperature	Air or GN_2			
A4367	1	Switch, Pressure	Fresh air intake high pressure	Minneapolis-Honeywell Regulator Co. P/N C645A-1006-1		181519B
A4368	1	Coil, Evaporator	Primary circuit	Dunham-Bush Inc. P/N 10701		
A4369	1	Coil, Evaporator	Primary circuit	Dunham-Bush Inc. P/N 10701		
A4370	1	Coil Evaporator	Primary circuit	Dunham-Bush Inc. P/N 10701		
A4371	1	Controller, Pneumatic	Water regulator	Black-Sivalls and Bryson Inc. Type 72-24-2		
A4372	1	Controller, Pneumatic	Water regulator	Black-Sivalls and Bryson Inc. Type 72-24-2		

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A4373	1	Controller, Pneumatic	Water regulator	Black-Sivalls and Bryson Inc. Type 72-24-2		
A4374	1	Valve, Manual	Refrigerant vent	Mueller Brass Co. P/N A15802		
A4375	1	Valve, Manual	Refrigerant vent	Mueller Brass Co. P/N A15802		
A4376	1	Valve, Manual	Refrigerant vent	Mueller Brass Co. P/N A15802		
A4377	1	Switch, Pressure	GN_2 high pressure supply	Minneapolis-Honeywell Regulator Co. P/N 444R		181S21b
A4378	1	Switch, Temperature	GN_2 high temperature	Minneapolis-Honeywell Regulator Co. P/N T675A-1060		181S18b
A4379	1	Tower, Water Cooling		Baltimore Aircoil Inc. P/N TMA175		182A1
A4380	1	Switch, Differential Pressure	Low flow rate cutout	F. W. Dwyer Mfg. Co. Model 1627-12		181S12
A4381	1	Switch, Differential Pressure	Low flow rate cutout	F. W. Dwyer Mfg. Co. Model 1627-12		181S3
A4382	1	Switch,Differential Pressure	Low flow rate cutout	F. W. Dwyer Mfg. Co. Model 1627-12		181S13
A4383	1	Switch, Differential Pressure	Low flow rate cutout	F. W. Dwyer Mfg. Co. Model 1627-12		181S38
A4384	1	Switch, Differential Pressure	Low flow rate cutout	F. W. Dwyer Mfg. Co. Model 1627-12		181S36

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A4385	1	Switch, Differential Pressure	Low flow rate cutout	F. W. Dwyer Mfg. Co. Model 1627-12		181S34
A4386	1	Switch, Differential Pressure	Low flow rate cutout	F. W. Dwyer Mfg. Co. Model 1627-12		181S25
A4387	1	Valve, Solenoid	50-psig control pressure	Marotta Valve Corp. P/N MV123C		181L1
A4388	1	Valve, Solenoid	50-psig control pressure	Marotta Valve Corp. P/N MV123C		181L2
A4389	1	Heat Exchanger	Refrigerant			
A4390	1	Heat Exchanger	Refrigerant			
A4391	1	Heat Exchanger	Refrigerant			
A4392	1	Switch, Pressure	Safety interlock			181A1A1-S53
A4393	1	Switch, Presure	Safety interlock			181A2A1-S53
A4394	1	Switch, Pressure	Safety interlock			181A3A1-S53
A4395	1	Sightglass	Moisture indicator			
A4396	1	Sightglass	Moisture indicator			

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A4397	1	Sightglass	Moisture indicator			
A4398	1	Transition Assembly				
A4399 through A4900 are not functionally applicable to this system.						
A4901	1	Valve, Pneumatic	NC, ball shutoff, solenoid-operated			
A4902 is not functionally applicable to this system.						
A4903	1	Valve, Pneumatic	N. O. ball shutoff, solenoid-operated			
A4904 is not functionally applicable to this system.						
A4905	1	Valve, Solenoid	NC, control pressure			
A4906	1	Valve, Solenoid	NC, control pressure			
A4907 is not functionally applicable to this system.						
A4908	1	Valve, Pneumatic	NC, ball shutoff			
A4909	1	Valve, Pneumatic	NC, ball shutoff			

Finding Number	Reqd	Component	Remarks	Vendor	Drawing Number	Elec. Sym.
A4910 through B319 are not functionally applicable to this system.						
B320	1	Coupling, Quick-Disconnect	Air or GN_2 input line connector	Calmec Mfg. Co. P/N 319	20M40000	
B321	1	Coupling, Quick-Disconnect	Air or GN_2 exhaust line	Calmec Mfg. Co. P/N 319	20M40000	
B322	1	Orifice	Instrument Compartment No. 1, vent		20M40117	
B323 through B501 are not functionally applicable to this system.						
B502	4	Coupling, Quick-Disconnect		Calmec Mfg. Co.	20M30450	
B503 through E58 are not functionally applicable to this system.						
E59	1	Thermistor	S-IV Stage engine compartment, temperature sensing			

SECTION 3

MECHANICAL SCHEMATICS

This section contains mechanical schematics that show the functional arrangement of the environmental conditioning systems components listed in section 2. For a definition of the mechanical symbols used, see MSFC-STD-162A.

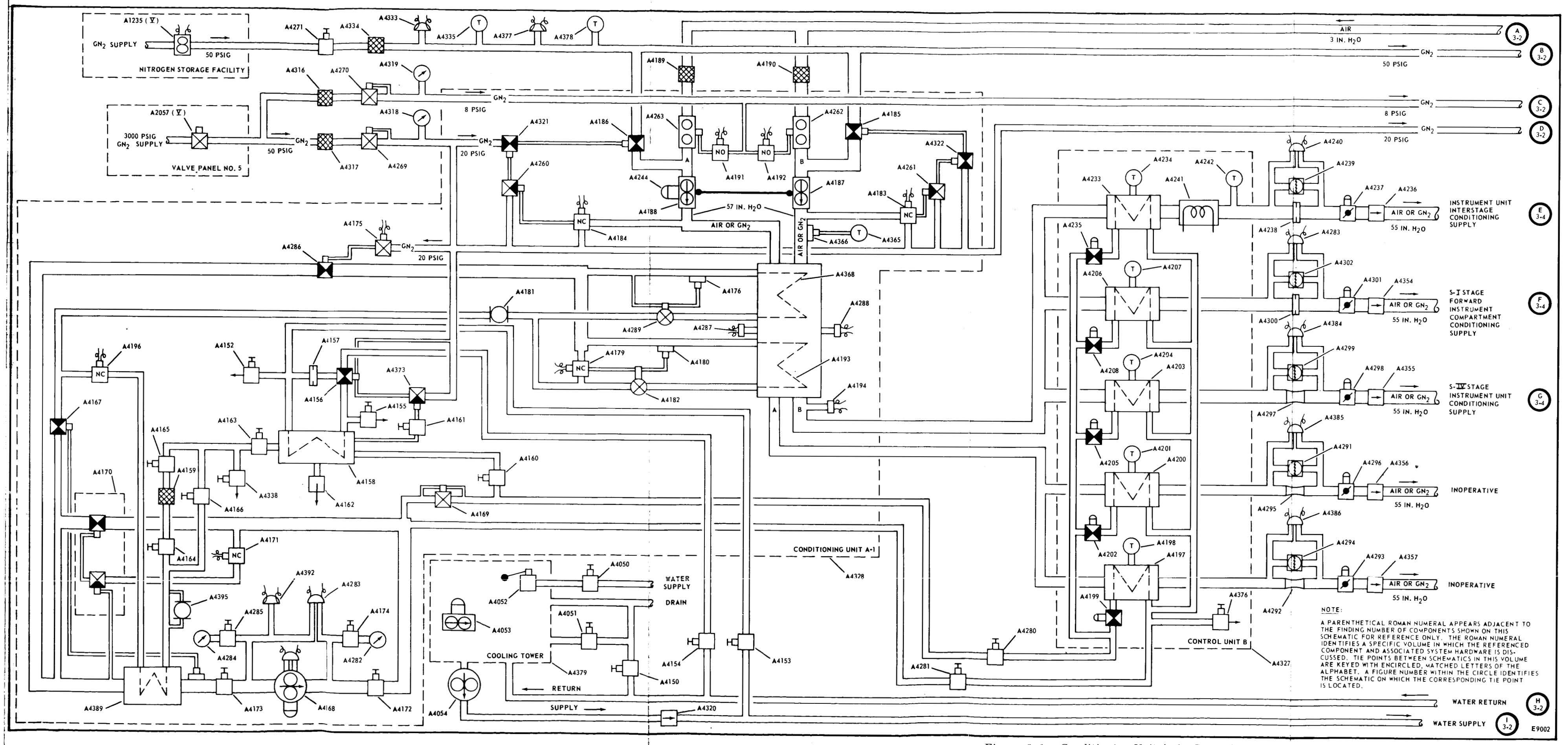

Figure 3-1. Conditioning Unit A-1, Control Unit B, and Water Cooling Tower-Mechanical Schematic

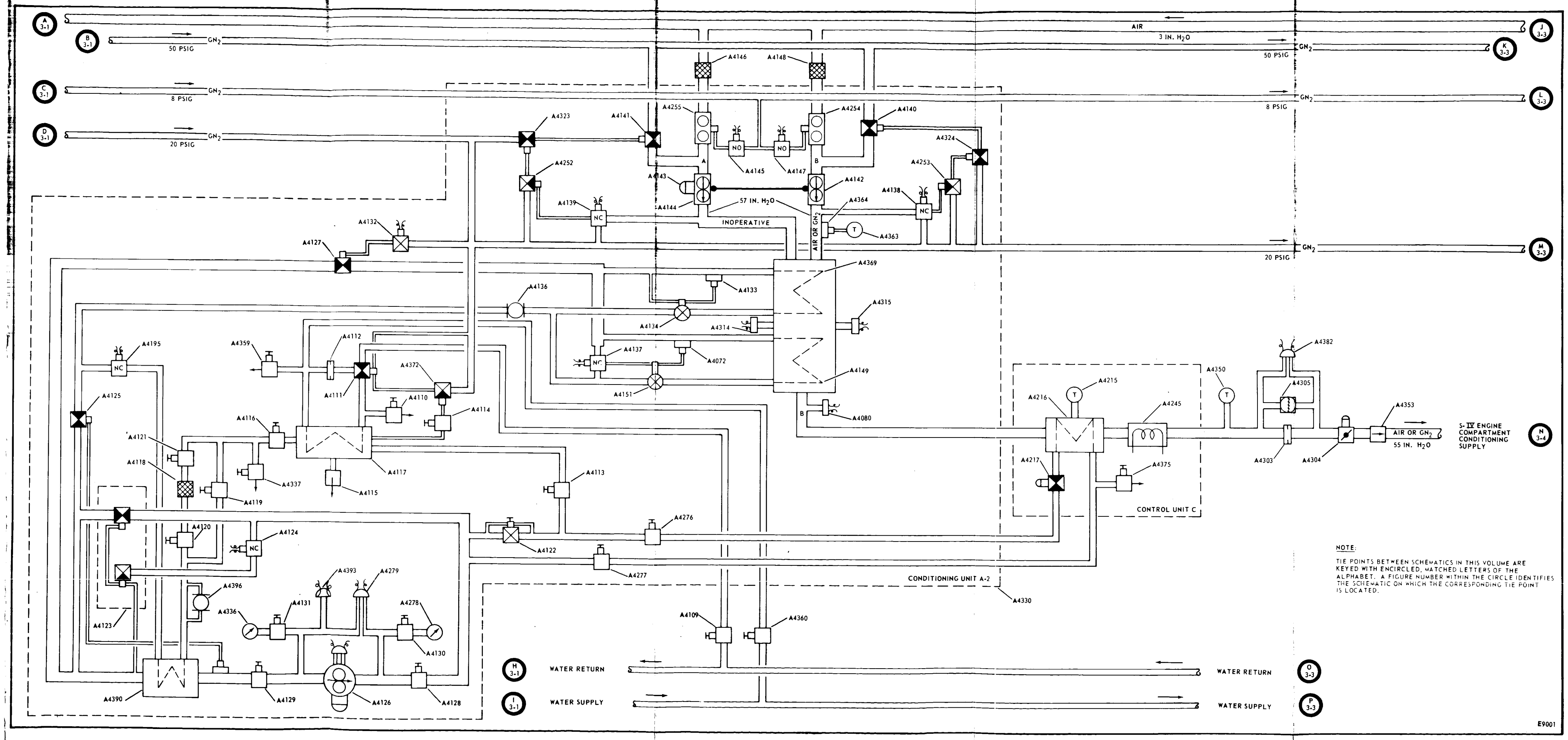

Figure 3-2. Conditioning Unit A-2 and Control Unit C-Mechanical Schematic

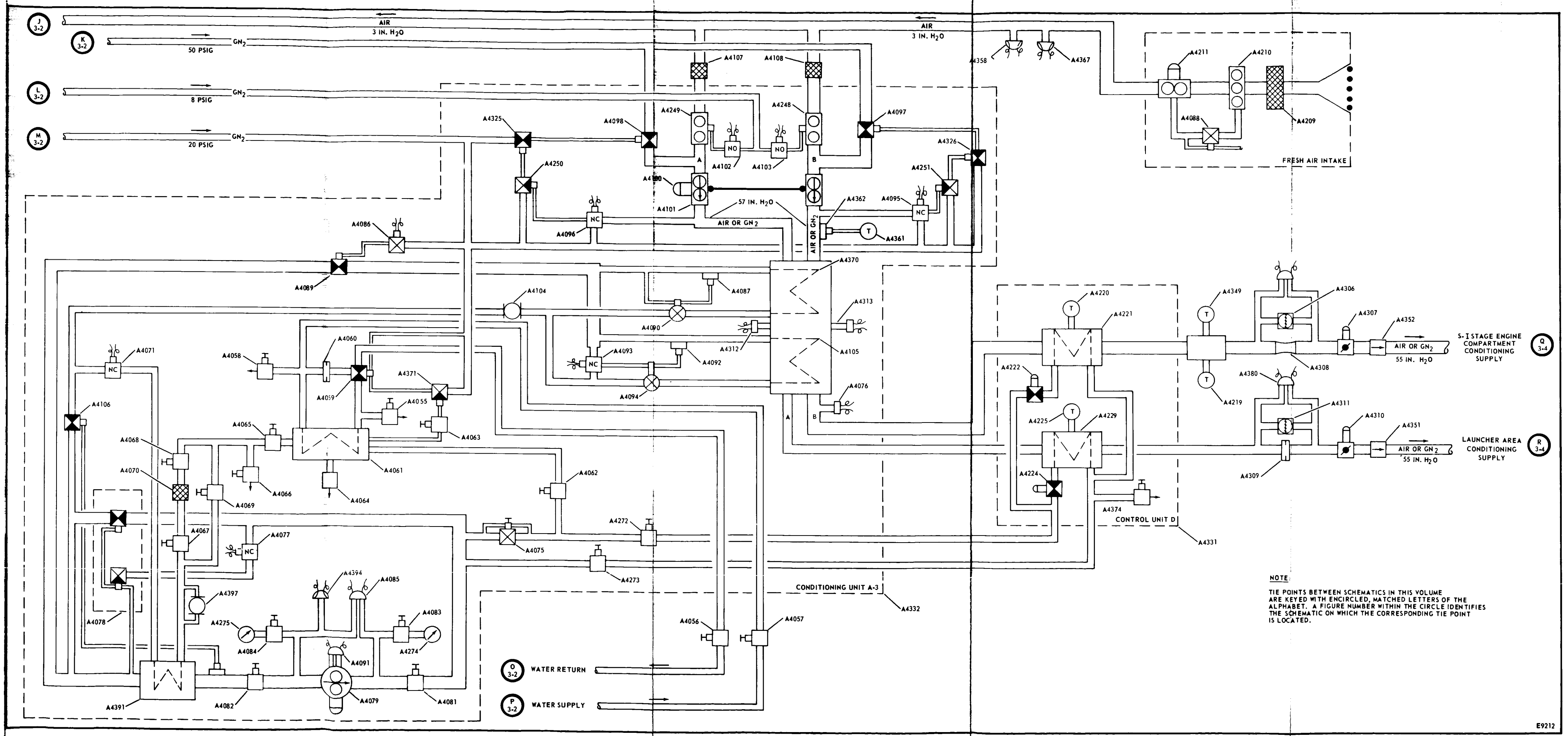

Figure 3-3. Conditioning Unit A-3, Control Unit D, and Remote Air Intake- Mechanical Schematic

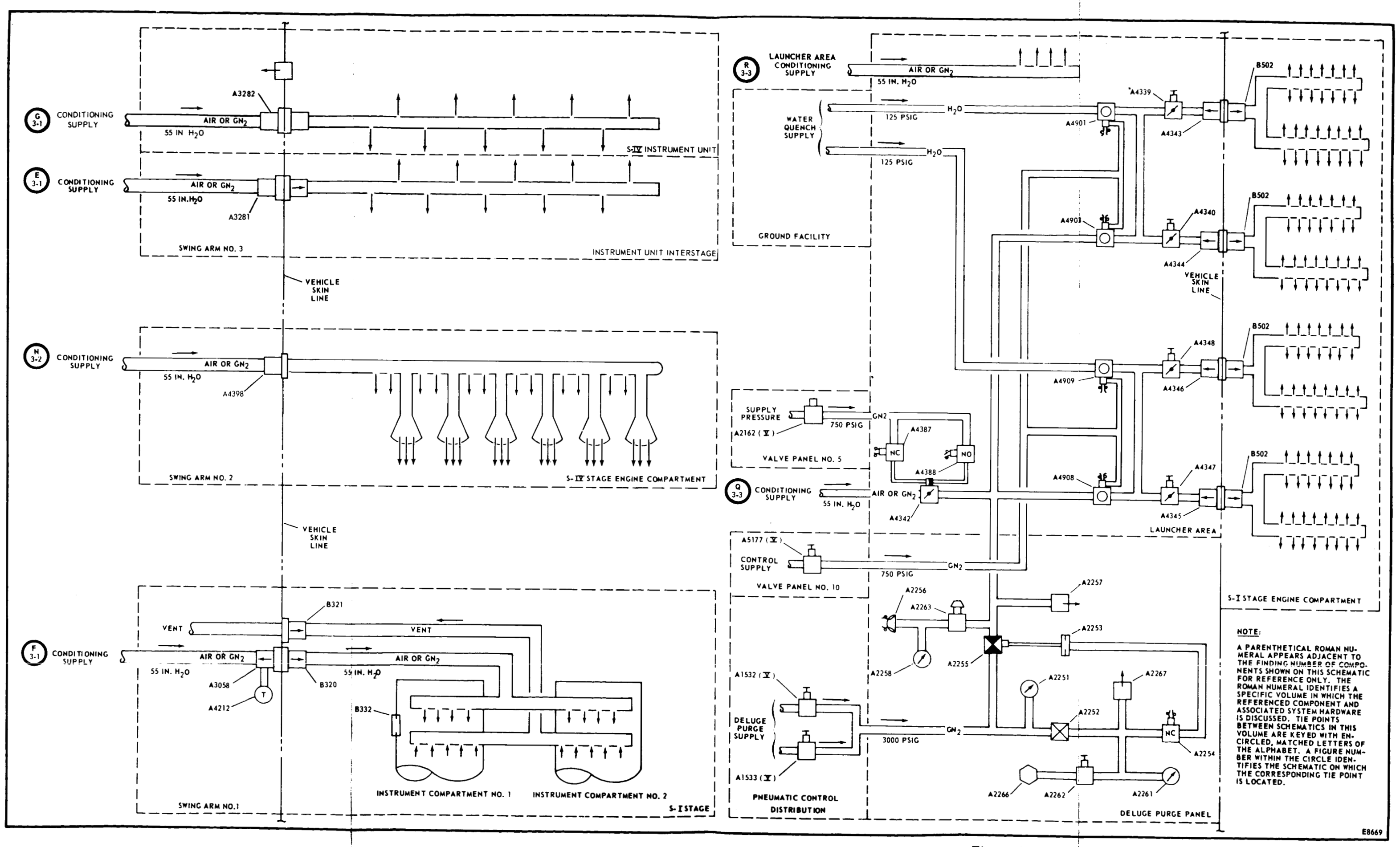

Figure 3-4. Vehicle Conditioning Systems-Mechanical Schematic